

supply fan supplying a sufficient flow of air so as to provide said protected zone with a positive pressure within the range from about 0.5 in wg. to about 1.5 in wg.

REMARKS

The Office Action was mailed on April 3, 2002, and set a shortened statutory period of three months for reply. Attached hereto is a Petition for an Extension of Time of One Month and authorization to charge the prescribed fee to Deposit Account No. 50-0967. Applicants hereby petition for any extension of time which may be required to maintain the pendency of this case, and any required fee for such extension in excess of the amount paid by check is to be charged to Deposit Account No. 50-0967.

Claims 1-20 are pending in the application as a result of the instant Amendment. In the Amendment, claims 1 and 11 are amended at the points indicated in the Office Action dated April 3, 2002, to correct prior errors in reproducing these claims from the parent application. Moreover, claims 1 and 11 are further amended for clarity, i.e., claims 1 and 11 have been amended to correct noted errors in grammar and not for purposes of narrowing the claims. The attached Appendix contains a clean copy of claims 1 and 11.

Attached hereto is a substitute Specification and a machine-generated red-lined version of the Specification, which compares the Specification after entry of the previously filed Preliminary Amendment and the substitute Specification. It is respectfully submitted that the substitute Specification does not introduce new matter into the above-identified application.

Paragraph 1 of the Office Action dated April 3, 2002, addressed Applicants' claim to priority. In light of the fact that Applicants indicated that the instant application is a Continuation in the Utility Patent Application Transmittal filed on November 30, 2001, and the fact that the substitute Specification expressly lays out the parentage of the instant application, it is respectfully submitted that Applicants have perfected their claim to priority under 35 U.S.C. §120.

That same paragraph provided gratuitous comments indicating that the present application "adds and claims additional disclosure not presented in the prior application." However, it is respectfully submitted that there is no basis for such a statement, as the Office Action does not

present a critical analysis of the additional matter and makes no assertion that the "additional disclosure" is, in fact, prohibited new matter. On the contrary, Applicants respectfully submit that the additional disclosure and claimed subject matter is properly included under the provisions of 37 C.F.R. §1.121(e), which states that:

(e) *Disclosure consistency.* The disclosure must be amended, when required by the Office, to correct inaccuracies of description and definition, and to secure substantial correspondence between the claims, the remainder of the specification, and the drawings.

In the instant case, the additional description and claiming with respect to free-standing filters and retaining mechanisms are fully supported by Figs. 2 and 3, respectively. Thus, the instant application is properly a Continuation, and not a Continuation-in-Part, application. It is respectfully requested that the Examiner acknowledge Applicants' claim to priority in the next Patent Office paper.

With respect to Paragraph 2, claims 1 and 11 are amended at the points indicated in the Office Action. It is respectfully submitted that these amendments render the objections moot.

With respect to Paragraph 3, it is submitted that the substitute Specification provides the needed antecedent basis. For that reason, Applicants respectfully request that the stated objection be withdrawn.

The Office Action rejects claims 18 and 20 under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one of ordinary skill in the art to which it pertains . . . to make and/or use the invention. The Office Action then states that "the limitation 'means to provide electromagnetic interference protection' is not sufficiently described in the specification." This rejection is respectfully traversed.

First, it is respectfully submitted that the burden of showing that the claimed invention is not described in the application rests on the Patent and Trademark Office in the first instance, and it is up to the Patent and Trademark Office to give reasons why a description not *in ipso verbis* is insufficient. See In re Edwards et al., 196 U.S.P.Q. 465,9 (C.C.P.A. 1978). In other words, in determining whether claims do, in fact, set out and circumscribe a particular area with a reasonable degree of precision and particularity, the definiteness of the language employed must be analyzed--not in a vacuum, but always in light of the teachings of the prior art and of the particular application

disclosure as it would be interpreted by one possessing the ordinary level of skill in the pertinent art. In re Moore and Janoski, 169 U.S.P.Q. 236 (C.C.P.A. 1971).

Second, it is well settled that there is no requirement in 35 U.S.C. §112 or anywhere else in the patent law that a specification convince persons skilled in the art that the assertions in the specification are correct. In examining a patent application, **the P.T.O. is required to assume that the specification complies with the enablement provision of Section 112 unless it has "acceptable evidence or reasoning" to suggest otherwise.** The P.T.O. thus must provide reasons supported by the record as a whole why the specification is not enabling. Then and only then does the burden shift to the applicant to show that one of ordinary skill in the art could have practiced the claimed invention without undue experimentation. See Gould v. Mossinghoff, 229 U.S.P.Q. 1, 13-14 (D.D.C. 1985), aff'd in part, vacated in part, and remanded sub nom., Gould v. Quigg, 822 F.2d 1074, 3 U.S.P.Q.2d 1302 (Fed. Cir. 1987). It is respectfully submitted that the mere assertion by the Examiner that "'free standing filters' and 'retaining mechanism' are not adequately described in the specification" clearly does not satisfy the minimum requirements set forth in the patent law for establishing a "prima facie" case of non-enablement by the U.S. Patent and Trademark Office.

Moreover, while the term "undue experimentation" does not appear in the statute, *i.e.*, 35 U.S.C. §112, first paragraph, it is well established that enablement requires that the specification teach those of ordinary skill in the art to make and use the present invention without undue experimentation. The key word is "undue," not "experimentation." In re Wands, 8 U.S.P.Q.2d 1400,4 (Fed. Cir. 1988).

"Hence, the issue becomes whether it would take undue experimentation for one of ordinary skill in this art to produce the system recited in claim 1 or to practice the corresponding method set forth in claim 11. Factors to be considered in determining whether a disclosure would require undue experimentation include:

- (1) the quantity of experimentation necessary,
- (2) the amount or direction of guidance presented,
- (3) the presence or absence of working examples,
- (4) the nature of the invention,
- (5) the state of the prior art,
- (6) the relative skill of those in the art,
- (7) the predictability or unpredictability of the art; and
- (8) the breadth of the claims.

In re Wands, 8 U.S.P.Q.2d 1400,4 (Fed. Cir. 1988).

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Since the entire basis of the 35 U.S.C. §112, first paragraph, rejection are assertions in the Office Action that certain claim language is not adequately described in the specification, it is evident that the Office Action has not even attempted to demonstrate why one of ordinary skill in the art would require undue experimentation in order to make and use the system recited in claim 1 or the corresponding method recited in claim 11. While the burden of proof is such that the Applicants need not bolster their position with arguments, Applicants will address several of the enumerated items in order to advance the prosecution on the merits.

With respect to Item (1), Applicants submit that one of ordinary skill in the art would require virtually no experimentation in order to practice the system and corresponding method recited in the pending claims. The limitations that the Office Action questions recite free-standing filters and retaining mechanisms. Both of these limitations were adequately disclosed in the parent application in Figs. 2 and 3, i.e., Figs. 2 and 3 clearly depict "free-standing" filters while Fig. 3 clearly depicts the retaining mechanisms, e.g., elements 46, 48, and/or 50, by which the free-standing filters are held in place during operation.

With respect to Item (2), Applicants submit that (2) the amount of direction and guidance presented is sufficient to make and use the claimed invention. Stated another way, Applicant cannot fathom what additional guidance one of ordinary skill in the art would require in order to practice the claimed invention.

With respect to Item (3), it is respectfully submitted that several working examples of the inventive system and corresponding method are illustrated in the figures and described in the specification. Thus, there is no lack of working examples.

With respect to Item (4), Applicants submit that the nature of the invention is a filtration system, which is found in the mechanical and electrical arts and, thus, in the wholly predictable arts.

With respect to Item (5), Applicants submit that the state of the prior art is clearly reflected in the art of record.

With respect to Item (6), Applicants again submit that the relative skill of those in the art is clearly established by the prior art of record.

With respect to Item (7), the predictability or unpredictability of the art, Applicants submit that the comments made regarding Item (4) clearly indicate that the invention lies in the predictable arts, as opposed to the unpredictable arts such as the chemical and biotech arts.

Finally, with respect to Item (8), the breadth of the claims, Applicants submit that the Office Action did not and cannot raise this issue.

For all of the reasons enumerated above, Applicants respectfully submit that the pending claims are fully enabled by the specification as originally filed. In that the Examiner has not set forth any evidence in support of the non-enablement rejection while the Applicant has submitted virtually incontrovertible evidence and argument, the Examiner is respectfully requested to reconsider and withdraw the 35 U.S.C. §112, first paragraph, rejection of claims 18 and 20.

The Office Action rejects 1, 3, 10, 11, and 18-20 under 35 U.S.C. §103(a) as being unpatentable over Linnersten et al. (U.S. Patent No. 6,152,996) in view of Thomaides et al. (U.S. Patent No. 4,838,903). This rejection is respectfully traversed.

35 U.S.C. §103 authorizes a rejection where to meet the claim, it is necessary to modify a single reference or to combine it with one or more other references. After indicating that the rejection is under 35 U.S.C. §103, the Examiner should set forth in the Office action (1) the relevant teachings of the prior art relied upon, preferably with reference to the relevant column or page number(s) and line number(s) where appropriate, (2) the difference or differences in the claim over the applied reference(s), (3) the proposed modification of the applied reference(s) necessary to arrive at the claimed subject matter, and (4) an explanation why such proposed modification would have been obvious to one of ordinary skill in the art at the time the invention was made. See M.P.E.P. §706.02(j).

Applicants respectfully submit that the Office Action has not set forth a “prima facie” case of obviousness, since the Office Action has failed to either consider the teachings of the references, as required by Item (2),¹ or to provide any motivation, as required by Item (4). In other words, the Office Action identifies three separate deficiencies in the teachings of the primary reference, i.e., the ‘996 patent, and then fails to rectify these deficiencies with any teachings from the secondary reference.

For example, the Office Action states that the ‘996 patent teaches that the filters can be

arranged for air flow in the opposite direction [i.e.], entering the air cleaner along its axis through the layers of the particulate filter located inside of the sorbent filter. The Office Action then admits that the instant claims differ from the teachings of the '996 patent in the arrangement of the filter layers such that the pre-filter is located within the second filter. It should be noted that the pre-filter 15 (215, 315) is a durable non-pleated outer wrap supported by a screen 14 (214, 314), which screen is disposed on the outside of the filters taught by the '996 patent. There is simply no teaching within the four corners of the '996 patent that permits the pre-filter 15 (215, 315) to be disposed within the HEPA filter 13 (213, 313). Moreover, the '903 patent positively teaches away from the arrangement at column 3, lines 26-31, wherein the '903 patent teaches that "sock," i.e., unsupported filters, cannot be employed in systems where the flow is directed radially outward through the pre-filter and filter, respectively.

From the discussion above, it will be seen that, at best, there is a conflict between the teachings of the references and, at worst, the references teach away from one another. With respect to the latter, it is respectfully submitted that one of ordinary skill in the art, following the guidance found in the '996 and '903 patents, would be led in a direction divergent from the path that was taken by the Applicants because the '996 patent does not teach Applicants claimed arrangement and because the '903 patent teaches away from modification of the '996 patent suggested in the Office Action. Since a reference which teaches away is a significant factor in determining obviousness, the nature of that teaching is highly relevant and must be considered. See In re Gurley, 31 U.S.P.Q.2d 1130 (Fed. Cir. 1994). The Examiner's analysis gives no weight to the teachings in the applied references which contradict the Examiner's position. This selective view of the '996 and '903 patents allow the Examiner to focus on elements described in expansive statements in the '996 patent while ignoring the fact that the '903 patent indicates the Office Action's filter arrangement is unworkable.

In the context of conflicting teachings, it is respectfully submitted that the '996 patent and the '903 patent are in conflict on multiple levels. For example, the '996 patent teaches a three-stage filter 10, where one stage is pleated paper and one stage is an immobilized mass of sorption material; the pre-filter appears to be cloth or foam material. In contrast, the '903 patent teaches filters and pre-filters comprising loosely packed fibers, which the '903 patent touts as being the most effective type of filters. Compare column 3, lines 3-45, of the '996 patent and column, lines 32-50, and column 4,

lines 27-34, of the '903 patent. Thus the '996 and the '903 patents are in conflict both with respect to filter construction and filter materials.

It is well settled that the test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art, and all teachings in the prior art must be considered to the extent that they are in analogous arts. Where the teachings of two or more prior art references conflict, the Examiner must weigh the power of each reference to suggest solutions to one of ordinary skill in the art, considering the degree to which one reference might accurately discredit another. See M.P.E.P. § 2143, citing In re Young, 18 U.S.P.Q.2d 1089 (Fed. Cir. 1991).

In short, with respect to Item (2) of a "prima facie" case of obviousness, it is respectfully submitted that the analysis of the references is wholly inadequate to support a combination of the references, primarily because the secondary reference teaches away from the primary reference. Since the Office Action does not even recognize the conflict between these references, the Office Action fails to provide a "prima facie" case of obviousness.

With respect to Item (3), the Office Action fails to identify the specific combination of elements taught by the references needed to obviate the invention recited in claim 1. More specifically, the Office Action has not even attempted to identify where one of the applied references teaches "a supply fan having an input fluidly coupled to said output of said three-stage air filter apparatus and an output fluidly coupled to said air intake means of said protected zone, said supply fan supplying an air at a sufficient enough flow so as to provide said protected zone with a positive pressure," as recited in claim 1. In fact, the Office Action apparently has selected references that are, at best, neutral with respect to fans or blowers. For example, the multistage filter taught by the '996 patent is described as suitable for aircraft ventilation, compressed air systems, and personal respirators. See column 2, lines 4-13 of the '996 patent. It will be appreciated that none of these applications dictate that the supply fan be disposed downstream of the multistage filter. As discussed in the instant application, the conventional "filters used in such pressurized systems [as airplane cabins] are commonly placed in relatively small environments, such as air ducts. It will be appreciated that this permits a single filter to filter both incoming and recirculated air. Moreover, the personal respiration application may not employ a fan of any type, since the wearer's lungs may provide the requisite "pumping" power.

In contrast, the two-stage filter taught by the '903 patent does not employ a pump at all. It will be appreciated by one of ordinary skill in the art that the repeated references to "candles" instead of filters, to "gas stream" and "processed gas," and to "treatment vessel 26" indicates that the '903 patent teaches a specific filter system employed in the top of a reactor vessel. In most such applications, the reactor vessel pressure provides sufficient head for the operation of the two-stage filter taught by the '903 patent. In other words, the '903 patent teaches away from the supply fan recited in claim 1.

Turning now to Item (4), the Office Action contains a tacit admission that neither of the applied references teach or even suggest the recited supply fan. More specifically, the Office Action states that:

"It would have been obvious to one having ordinary skill in the art at the time of the invention to modify the system of Linnersten et al. ('996) to include mounting of the filter in any suitable configuration governed by space constraints and the arrangement of the filter inlet and outlet and to use a plenum where multiple filters are used in parallel, such as in high-flow operations that could not be accommodated by a single filter assembly. The absolute pressure maintained within the enclosed space would have been obvious to one skilled in the art as determined by the desired efficiency of the system required, and it is submitted that a blower can be placed in any suitable place in the gas supply line for providing a pressure differential sufficient to [generate] a positive flow into and out of the filter assembly."

Since the Office Action has failed to point out the location of a teaching or suggestion of, for example, the supply fan positively recited in claim 1 within the four corners of either of the applied references, there is no motivation, absent impermissible hindsight, for adding the claimed supply fan to the filters actually taught be either one of the applied references to create the system actually recited in independent claim 1. **The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure.** See M.P.E.P. §2143, citing In re Vaeck, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991).

Moreover, the statement quoted above from the Office Action fails to provide any reasoning, much less cogent reasoning, as to why one of ordinary skill in the art would be motivated to provide the claimed system and corresponding method. Motivation normally addresses "why" the

combination would be made; the Office Action merely indicates that one of ordinary skill in the art could provide the claimed system once the multistage filter taught by the '996 patent, as modified by a single, isolated teaching from the '903 patent, were available to him/her. It is respectfully submitted that the Office Action merely indicates that one of ordinary skill in the art would be able to produce the system recited in claim 1 given the three-stage filter taught by the '996 patent and ignoring the fact that the principal teaching of the '903 patent is a two-stage filter. Thus, the Office Action fails to set forth a prima facie case of obviousness. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. See M.P.E.P. § 2143, citing In re Mills, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990). A statement that modifications of the prior art to meet the claimed invention would have been " 'well within the ordinary skill of the art at the time the claimed invention was made' " because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a prima facie case of obviousness without some objective reason to combine the teachings of the references. See M.P.E.P. § 2143, citing Ex parte Levengood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993).

In short, since the 903 patent teaches away from the arrangement of the filters taught by the '996 patent, the Office Action has not set forth a "prima facie" case of obviousness. Moreover, since neither of the applied references teach the supply fan positively recited in claim 1, and since many of the specific applications of the filters taught by the applied references do not employ fans of any type, no possible combination of the applied references, either alone or in combination, could teach a system containing a supply fan. Thus, there is a second, independent reason for asserting that the Office Action has failed to set forth a "prima facie" case of obviousness.

Moreover, it is well settled that, during examination, it is axiomatic that not only must claims be given their broadest reasonable interpretation consistent with the specification, but also all limitations must be considered. The characterization of certain limitations or parameters as obvious does not make the claimed invention, considered as a whole, obvious. See Ex parte Peterson, 228 U.S.P.Q. 216, 217 (Pat. Off. Bd. App. and Inter. 1985). Applicants respectfully submit that terms found in a claim may not be ignored and that all words in a claim must be considered in evaluating patentability over the prior art. Stated another way, since the Office Action has not addressed

expressly recited limitations of claims 1 and 11, e.g., “a supply fan having an input fluidly coupled to said output of said three-stage air filter apparatus and an output fluidly coupled to said air intake means of said protected zone, said supply fan supplying an air at a sufficient enough flow so as to provide said protected zone with a positive pressure,” the Office Action cannot, and has not, set forth a “prima facie” case of obviousness. The Office Action merely states “the absolute pressure maintained within the enclosed space would have been obvious to one of ordinary skill in the art;” such conclusory statements cannot avoid the cogent arguments necessary to a “prima facie” case of obviousness.

Finally, and in any even, the test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art, and all teachings in the prior art must be considered to the extent that they are in analogous arts. Where the teachings of two or more prior art references conflict, the Examiner must weigh the power of each reference to suggest solutions to one of ordinary skill in the art, considering the degree to which one reference might accurately discredit another. See M.P.E.P. § 2143, citing In re Young, 18 U.S.P.Q.2d 1089 (Fed. Cir. 1991). Thus, it is the teachings of the prior art as a whole that determine whether an invention is obvious. The Office Action cannot simply either ignore a reference that teaches away from the claimed invention or extract isolated teachings from a reference while ignoring what the reference “as a whole” would teach to one of ordinary skill in the art. For example, when considering the problem that the above-identified application addresses, given the ‘966, the ‘903 patents actually applied in rejecting claims 1 and 11, and given the patent to Frawley et al. (U.S. Patent No. 5,327,744; of record), one of ordinary skill in the art would have merely adapted the teachings of the ‘744 patent to shipboard or land based applications and ignored the teachings of the ‘996 and the ‘903 patents as being completely superfluous. One of ordinary skill in the art would also appreciate that the ‘744 patent teaches away from the claimed invention by its teaching of a pressurized system, i.e., a blower of some description, disposed upstream of a HEPA filter 32 and a pair of parallel regenerative bed filters 32-1 and 34-2. It is respectfully submitted that the Office Action cannot develop a “prima facie” case of obviousness by ignoring or selectively applying a reference that clearly teaches away from both the claimed invention and the references actually applied in rejection the claimed invention as obvious.

For all of the reasons set forth above, the Examiner is respectfully requested to reconsider and withdraw the 35 U.S.C. §103(a) rejections of claims 1 and 11. Claims 3, 10, and 18-20, depending from independent claim 1 are allowable for all of the reasons given with respect to claim 1.

The Office Action rejects 2 and 12 under 35 U.S.C. §103(a) as being unpatentable over the '996 patent in view of the '903 patent, as applied to claims 1 and 11, and further in view of Berghou et al. (U.S. Patent No.3,218,997). This rejection is respectfully traversed.

It is respectfully submitted that if the Office Action has failed to set forth a "prima facie" case of obviousness with respect to claims 1 and 11 before the '997 patent is added to the combination, it certainly cannot establish the rationale supporting an obviousness rejection once the '997 is included in the combination. The '997 patent teaches a system wherein a dynamic precipitator 44, i.e., a rotary blower type precipitator operating a 1200 r.p.m. at a flow rate of 4,000 c.f.m. and developing a total head of 5 inches of pressure, is disposed upstream of the filter assembly 53. See Fig.1 and column 3, lines 1-5. Thus, the '997 patent also teaches away from the specific arrangement of a supply fan recited in claims 1 and 11.

Moreover, Applicants submit that one of ordinary skill in the art would not have attempted to extract any teachings from the '997 patent, since the '997 patent teaches a system that would preferably operate at a negative pressure in order to minimize the spread of radioactive contamination. In any event, the filter system taught by the '997 patent, while a three stage system, employs a water spray to remove ash fines, a rotary precipitator, and a ceramic filter assembly. Thus, the tertiary reference conflicts with the primary and secondary references.

Since the applied references fail to set forth a "prima facie" case of obviousness with respect to independent claims 1 and 11, the combination of references cannot render dependent claims 2 and 12, depending respectively therefrom, obvious.

The Office Action also rejects claims 4, 5, 13, and 14 under 35 U.S.C. §103(a) as being unpatentable over the '996 patent in view of the '903 patent, and further in view of Repp et al (U.S. Patent No. 4,962,371). This rejection is again traversed. More specifically, since the Office Action has failed to set forth a "prima facie" case of obviousness with respect to claims 1 and 11 before the '371 patent is added to the combination, it certainly cannot establish the rationale supporting an

obviousness rejection once the '371 is included in the combination. In other words, since the '371 patent is not cited as correcting, and doesnot correct, the deficiencies discussed above with respect to the combination of the '996 and '903 patents, the proposed combination of reference cannot render the invention recited in claims 1 and 11 obvious. Claims 4 and 5, depending from claim 1, are allowable for all of the reasons given with respect to claim 1. Moreover, claims 13 and 14, depending from independent claim 11, are allowable for all of the reasons set forth with respect to claims 1 and 11.

Moreover, the Office Action rejects claims 6 and 15 under 35 U.S.C. §103(a) as being unpatentable over the '996 patent in view of the '903 patent, and further in view of the '744 patent (discussed above). This rejection is also traversed. More specifically, since the Office Action has failed to set forth a "prima facie" case of obviousness with respect to claims 1 and 11 before the '744 patent is added to the combination, it certainly cannot establish the rationale supporting an obviousness rejection once the '744 patent is included in the combination. Moreover, since the '744 patent clearly teaches away from the claimed invention, the combination cannot possibly teach or suggest the system recited in claim 1 or the corresponding method recited in claim 11. Moreover, since the '744 patent is not cited as correcting, and clearly doesnot correct, the deficiencies discussed above with respect to the asserted combination of the '996 and '903 patents, the proposed combination of reference cannot render the invention recited in claims 1 and 11 obvious. Claims 6 and 15, depending respectively from claims 1 and 11, are allowable for all of the reasons given with respect to independent claims 1 and 11.

Finally, the Office Action rejects claims 7-9, 16, and 17 under 35 U.S.C. §103(a) as being unpatentable over the '996 patent in view of the '903 patent, and further in view of the You et al. (U.S. Patent No. 5,890,367). This rejection is again traversed. More specifically, since the Office Action has failed to set forth a "prima facie" case of obviousness with respect to claims 1 and 11 before the '367 patent is added to the combination, it certainly cannot establish the rationale supporting an obviousness rejection once the '367 patent is included in the combination. Moreover, since the '367 patent clearly teaches away from the claimed invention by teaching locating particulate filters 1c and 1d upstream of a fan 1i and locating HEPA filter 1h and chemical filter downstream of the fan 1i (see Fig. 3 and column 4, lines 32-44), the combination cannot possibly

teach or suggest the system recited in claim 1 or the corresponding method recited in claim 11. Moreover, since the '367 patent is not cited as correcting, and clearly does not correct, the deficiencies discussed above with respect to the asserted combination of the '996 and '903 patents, the proposed combination of reference cannot render the invention recited in claims 1 and 11 obvious. Claims 7-9 and claims 16 and 17, depending respectively from claims 1 and 11, are allowable for all of the reasons given with respect to independent claims 1 and 11.

In light of the amendments and remarks presented above, it is respectfully submitted that the application is in condition for allowance, and such action is hereby solicited.

If any points remain in issue which the Examiner feels may best be resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Respectfully submitted,



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Enclosures:

1. Substitute Specification
2. Red-lined Specification

Date: July 12, 2002

Atty. Docket No.: NC 79363A

APPENDIX

IN THE CLAIMS:

B¹ 1. A system for supplying an enclosed protected zone having air intake means with an air supply having an inlet and that is filtered to remove contaminants created by chemical, biological or radiological conditions, said system comprising:

a) a three-stage air filter apparatus having an input fluidly coupled to said inlet and having an output, said three-stage air filter apparatus having first, second and third coaxially arranged annular filters, with the first filter being disposed within the second filter and the second filter being disposed within the third filter, and with the first filter being positioned closest to said input and the third filter being positioned closest to said output, said first filter filtering and removing particulates of at least a first size, said second filter filtering and removing aerosols and particulates of a size which is less than said first size, and said third filter comprising a gas adsorber for removing gases; and

b) a supply fan having an input fluidly coupled to said output of said three-stage air filter apparatus and an output fluidly coupled to said air intake means of said protected zone, said supply fan supplying an air at a sufficient enough flow so as to provide said protected zone with a positive pressure.

B² 11. A method for supplying an enclosed protected zone having air intake means with an air supply having an inlet and that is filtered to remove contaminants created by chemical, biological or radiological conditions, said method comprising the steps of:

a) providing a three-stage air filter apparatus having an input fluidly coupled to said inlet and an outlet, said three-stage air filter apparatus having first, second and third coaxially arranged annular filters, with the first filter being disposed within the second filter and the second filter being disposed within the third filter, and with the first filter being positioned closest to said input and the third filter being positioned closest to said output, said first filter filtering and removing particulates of at least a first size, said second filter filtering and removing aerosols and particulates of a size which is less than said first size, and said third filter comprising a gas adsorber for removing gases; and

cont
B2 b) providing a supply fan having an input fluidly coupled to said output of said three-stage air filter apparatus and an output fluidly coupled to said air intake means of said protected zone, said supply fan supplying a sufficient flow of air so as to provide said protected zone with a positive pressure within the range from about 0.5 in wg. to about 1.5 in wg.



MACHINE GENERATED RED-LINE
VERSION OF THE
SPECIFICATION

AIR SUPPLY SYSTEM PARTICULARLY SUITED TO REMOVE
CONTAMINANTS CREATED BY CHEMICAL, BIOLOGICAL OR
RADIOLOGICAL CONDITIONS

CROSS REFERENCE TO RELATED APPLICATIONS

This is a Continuation of Serial No: 09/504,396, which was filed on February 15, 2000,
and which is now abandoned.

STATEMENT OF GOVERNMENT INTEREST

The invention described herein made be manufactured and used by or for the Government
of the United States of America for governmental purposes without any payment of any royalties
thereon or therefor.

BACKGROUND OF THE INVENTION

1.0 Field of the Invention

The present invention relates to air filtering systems and, more particularly, to an air
supply system that is particularly suited to filter and remove contaminants created by chemical,
biological or radiological conditions.

2.0 Description of the Related Art

Tactical locations, such as naval warships and land based buildings used for command
information centers, have long been pressurized to protect against airborne intrusion therein of
chemical, biological and radiological contaminations, such as the system is disclosed in U.S.
patent 4,962,371, which is herein incorporated herein by reference. Although the existing systems
that provide for a pressurized environment serve well their intended purpose, it is desired that
further improvements be provided thereto.

The filters used in such pressurized systems are commonly placed in relatively small environments, such as air ducts. It is desired that a compact filtering apparatus be provided wherein all the filtering required to purge the air of contaminants is located in one compact structure.

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The pressurized environment provided by the air filtering systems needs to be maintained at a predetermined positive pressure. It is desired that a system be provided that monitors for the pressure within the enclosed environment and maintains the pressure therein within a desired limit.

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OBJECTS OF THE INVENTION

It is a primary object of the present invention to provide an air filtering system that is particularly suited to filter and remove contaminants created by chemical, biological or radiological conditions.

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Another object of the present invention is to provide an air supply system that has a single air filtering apparatus, which houses all of the necessary filtering devices needed to purge the supplied air of contaminants.

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It is another object of the present invention to provide for a system that monitors the positive pressure within an enclosed environment or zone protected by the system so as to be within a desired range.

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SUMMARY OF THE INVENTION

The invention is directed to an air supply system that is particularly suited to filter out contaminants created by chemical, biological or radiological conditions.

The system comprises a three-stage air filter apparatus and a supply fan. The three-stage air filter apparatus has an input and an outlet, with the input fluidly coupled to the inlet of the air supply system. The three-stage air filter apparatus has first, second and third coaxially arranged annular filters, with the first filter being disposed within the second filter and the second filter being disposed within the third filter. The first filter is located closest to the input of the three-stage air filter apparatus and the third filter is located closest to the output of the three-stage air filter apparatus. The first filter filters and removes particles of at least a first size. The second filter filters and removes aerosols and particles of a size which is less than the first size. The third filter comprises a gas adsorber for removing gases. The air supply system has an input fluidly coupled to the output of a three-stage air filter apparatus and an output fluidly coupled to the air intake means of the protected zone. The supply fan supplies a sufficient flow of air so as to provide the protected zone with a positive pressure.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the present invention may be realized when considered in view of the following detailed description, taken in conjunction with the accompanying drawings.

Fig. 1 is a block diagram showing the interrelationship of the elements making up the air supply system of the present invention.

Fig. 2 is a perspective view showing the annular disposed three filters making up the three-stage air filter apparatus of the present invention.

Fig. 3 illustrates the placement of the three-stage air filter apparatus within the air filtering system of the present invention.

Fig. 4 is a functional flow diagram of the air supply system of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, wherein the same reference number indicates the same element throughout, there is shown in Fig. 1 a block diagram showing the interrelationship of the essential elements making up the air supply system 10 of the present invention.

The system 10 supplies an enclosed protected zone 12, having an air intake means 14, with an air supply having an inlet 16 that is coupled to the external environment. The system 10 is particularly suited to provide filtering to remove contaminants created by chemical, biological or radiological conditions.

The protected zone 12 is defined by enclosed boundaries and is airtight. The practice of this invention frees the personnel in this zone from wearing protective masks or clothing, otherwise required to prevent the detrimental effects created by the chemical, biological and radiological contamination.

The protected zone 12 is pressurized by supplying air at a sufficient flow and maintaining the positive pressure by providing air tightness of the protected zone 12 itself and by the use of air locks. Maintaining a positive pressure with the protected zone 12 prevents the infiltration therein of the chemical and biological contaminants. The contaminants are removed from the air flowing into the pressurized zone 12 by a three-stage air filter apparatus 18.

The three-stage air filter apparatus 18 has a first filter 20, a second filter 22, and a third filter 24, all of which are annular coaxially arranged filters. The first filter 20 is disposed within the second filter 22, and the second filter 22 is disposed within a third filter 24 in a manner to be further described herein after with reference to Fig. 2. The first filter 20 is physically located closest to the input of the three-stage air filter apparatus 18, and the third filter 24 is physically located closest to the output of the three-stage air filter apparatus 18.

A differential pressure gage 26 is connected between the input and the output of the three-stage air filter apparatus 18 and develops an output proportional to the differences between the pressure sensed therebetween. The differential pressure gauge 26 may be used as a means for verifying the operation of the three-stage air filter apparatus 18, that is, a relatively low value indicated by the gauge 26 is representative that the filters therein are not clogged and that the three-stage air filter apparatus 18 is performing correctly.

The air supply system 10 further comprises a supply fan 28 which preferably is a centrifugal type fan and is also preferably shock-mounted to a structural foundation. The supply fan 28 is selected, in a manner known in the art, so as to supply a sufficient amount of air at a sufficient flow so as to provide the protected zone 12 with a positive pressure of 1.0 inches wg. The supply fan 28 is located on the downstream side of the three-stage filter apparatus 18 and cooling coils 30.

The cooling coils 30 are installed downstream of the three-stage filtering system 18 so as to condition (cool if warm) the supplied air before distributing it to the supply fan 28.

The protected zone 12 further cooperates with air locks 32 known in the art. The air locks 32 are used for the ingress and egress of personnel to and from the protected zone 12 so as to prevent accidental contamination of the protected zone 12 during periods of chemical and biological threats.

The protected zone 12 further utilizes fan/natural exhaust equipment 34 known in the art. The exhaust system 34 removes air from the protected zone 12 the amount of which is balanced with the air supplied by system 10 to the protected zone 12 so as to provide and maintain the desired amount of positive pressure within the protected zone 12.

The protected zone 12 further utilizes zone pressure gages 36, which are monitored to ensure that the protected zone 12 is supplied with a positive pressure within a desired range

typically from about 0.5 inches (in) wg to about 1.5 inches (in) wg. The zone pressure gages 36 operatively cooperate with an alarm system 38.

5 The alarm system 38 monitors the pressure in the protected zone 12 indicated by the zone pressure gauges 36 and provides an audible alarm to alert personnel of low pressure conditions therein. The alarm may be generated when the pressure within the protected zone 12 falls below 0.5 inches wg. Alarm systems are known and one such system is described in the previously incorporated by reference U.S. Patent 4,962,371.

10 The protected zone 12 further preferably includes an opening with an input and an output, wherein a pressure control valve (PCV) 40 is installed. The pressure control valve (PCV) 40 provides fluid communication between the input and output of the opening and is dimensioned, in a manner known in the art, so as to allow for fluid communication therebetween when the positive pressure within a protective zone is greater than about 1.5 inches wg. Preferably the protected
15 zone 12 includes the use of one pressure control valves 40, which is used to relieve excess air from the protected zone 12 and, thus, prevents excessive pressure therein from creating undesired air leaks.

20 The air supplied into the protected zone 12 originates ~~form~~from inlet 16, that is preferably directed into a coarse-filter 42. The coarse-filter 42 typically uses a metal mesh to prevent large particles from entering the air supply system 10. The output of the coarse-filter 42 is directed into a preheater 44.

25 The preheater 44 conditions the air before it enters the three-stage air filter apparatus 18, which may be further described with reference to Fig. 2. As seen in Fig. 2, the three filters 20, 22, and 24 of the three-stage air filter apparatus 18, already discussed with reference to Fig. 1, are annular in shape and coaxially arranged, with filter 20 being dimensioned to be insertable into filter 22 which, in turn, is dimensioned so as to be insertable into filter 24. The filters 20, 22, and 24 are radial flow types, wherein air enters the inner (filter 20) diameter area and flows radially

outward through the larger (filter 24) diameter surface. It will be appreciated from Fig. 2 that filters 20, 22, and 24 are free-standing filters. The first filter 20 has a typical outer diameter of twelve (12) inches and has a typical length of 10 inches. The first filter is a pleated-medium which filters and removes particles of at least a first or relatively small size. The second filter 22 filters and removes aerosols and particulates of a size which is less than the first size of the particles being removed by the first filter 20. The second filter 22 is selected of a material, known in the art, for removing solid and aerosol chemical, biological and radiological contaminants. The third filter 24 comprises a gas adsorber which removes gases. The third filter 24 contains activated charcoal (aszm-teda charcoal (chromium free)) selected, in a manner known in the art, for removing chemical warfare gases. The placement of the three-stage air filter apparatus 18 and further details thereof within a system, such as that of system 10, may be further described in reference to Fig. 3.

Fig. 3 illustrates one three-stage air filter apparatus 18 further having a gas cover 46 that is placed over the third filter 24 and a NEPA cover 48, which is placed over the second filter 22 and a clamp 52, which is over the third filter 20. The gas cover 46 and NEPA cover 48 are attached by a nut 50, whereas the third filter 20 is attached by way of a clamp 52 and a nut 54. It will be appreciated from Fig. 3 that the second and third filters 22, 24 are held in place by retaining mechanisms, e.g., the gas cover 46 and the NEPA cover 48, while the first filter 20 held in place by friction, i.e., a press fit.

The system 10 preferably includes five three-stage air filter apparatuses 18, but only one is shown in Fig. 3 for the sake of clarity. The five three-staged air filter apparatuses 18 are each housed in an opening 56 with each of the filters 20, 22 and 24 disposed inside each opening 56. The openings 56 open into an outlet plenum 58 which has curved upper portions (shown in Fig. 3) that provide an air flow which is directed toward the air supply 28 (not shown).

The input air originally from inlet 16 of Fig. 1 is indicated in Fig. 3 by directional arrow 62, and a watertight access door 64, similar to those used for the air locks 32, is generally

indicated by reference number 64 and forms part of a bulkhead 66. The support for the openings 56 is provided by the bulkhead 68 and the structural support of the outer plenum 58 is provided by a deck 70. The output air exiting from the outer plenum 58 is indicated in Fig. 3 by directional arrow 60. The operation of the system 10 can be further described with reference to Fig. 4.

Fig. 4 shows a functional flow diagram 72 of the operation of the present invention. Fig. 4 illustrates the elements previously described with reference to Figs. 1, 2, and 3, but in addition thereto illustrates a thermostat 74 that is used to control the cooling coils 30. Fig. 4 further shows a block 76 that represents controlled leaks through doors, hatches etc., that are treated as exhaust generally identified by the use of reference number 78.

In general the operation of the system 10 includes supplying an adequate amount of air filtration of the air that is used to pressurize the protected zone 12 and monitoring for and maintaining the protected pressurized zone 12 so that its positive pressure is within a desired range of between 0.5-1.5 in. wg.

In operation, the air provided from inlet 16 is divided into three elements, identified in Fig. 4 by three different paths 80, 82 and 84 that respectively represent particulates, aerosols, and gases. The three paths are preferably first intercepted by the coarse-filter 42.

The coarse-filter 42 has typical dimensions of 19.5 by 29.5 inches. The coarse-filter 42 filters out large particulates and then directs the paths 80, 82 and 84 onward to the preheater 44.

The preheater 44 elevates the air passing thereover to a temperature of at least 42° F and having a relative humidity of about 70%. The preheater 44 is preferably controlled by a thermostat 86. The preheater 44 directs the three paths 80, 82 and 84 onward to the first filter 20.

The first filter 20 removes relatively large particles and then directs the paths 80, 82 and 84 onward to the second filter 22.

The second filter 22 removes fine particulates and aerosols of 0.3 microns or greater with efficiencies of greater than 99.97 from its received air and delivers an output which only comprises gases that are directed to the third filter 24.

5 The third filter 24 removes the gas by an adsorption operation and passes air free, indicated by directional arrow 88, from the contaminants, especially those created by unwanted chemical, biological and radiological conditions, that is directed to the outlet plenum 58 which, in turn, direct the air 88, free from contaminants, onward to the cooling coils 30.

10 The cooling coils 30, in response to the thermostat 74, supplies the same air 88 free from contaminants to the supply fan 28 which, in turn, provides filtered air 88 free of contaminants into the protected zone 12.

15 The protected zone 12 is maintained by means of the pressure transducers 36 and its related alarm system 38 as well as the pressure control valves 40 and is supplied with a continuous flow air 88 free from contaminants.

20 It should now be appreciated that the practice of the present invention provides for an air supply system that is particularly suited to filter out contaminants created by chemical, biological or radiological conditions.

25 It should be further appreciated that the air supply system utilizes a three-stage air filter apparatus that contains all of the necessary filtering element, and because of its single structure, is conveniently mounted into bulkheads related to the system 10 of the present invention.

Still further is should be appreciated that the pressure transducer in cooperation with the alarm circuits allows for the monitoring of the protected zone so as to maintain its filtered air within a desired limit, such as 0.5 - 1.5 inches wg.

While the invention has been described with reference to the specific embodiments, this description is illustrative and is not to be construed as limiting the scope of the invention.

5 Various modifications will occur to those skilled in the art without departing from the spirit and scope of the invention as defined by the appended claims.